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(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 013 038**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 79200686.8

(22) Date of filing: 21.11.79

(51) Int. Cl.³: F 04 D 1/12

(30) Priority: 22.12.78 NL 7812468

(43) Date of publication of application:
09.07.80 Bulletin 80/14

(84) Designated Contracting States:
AT BE CH DE FR GB IT NL SE

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(54) **A pump of the Pitot type.**

(57) The pump comprising a rotatably drivable pump housing (5) having a concentric, cylinder-disc-shaped pump space (6) in which opens out an inlet duct (7) for introducing a fluid and near the circumferential wall of which is located the inlet port of at least one fixed Pitot member (11) communicating with an outlet duct (9). According to the invention the Pitot member (11) is formed by a non-circular disc arranged in the pump space and having such a shape that together with the walls of the pump space it bounds at least one semi-sickle-shaped pump chamber (12) terminating in the direction of rotation of the pump housing in a substantially radial wall (14) having at least one outlet port (16).

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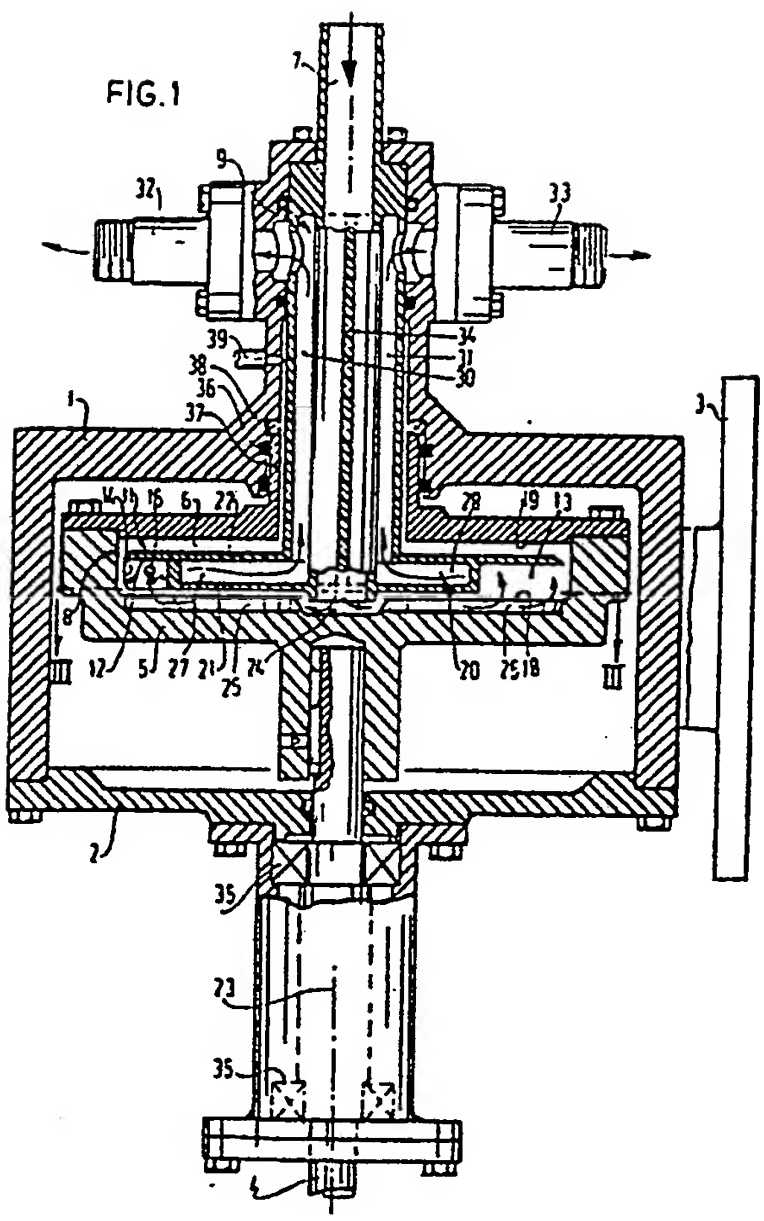
FIG.1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"A pump of the Pitot type"

The invention relates to a pump of the Pitot type comprising a rotatably drivable pump housing having a concentric, cylinder-disc-shaped pump space, in which an inlet duct for the introduction of fluid opens out and near the circumferential wall of which is located the outlet port of at least one fixed Pitot member communicating with an outlet duct. Such a pump is known from Dutch Patent Application No. 7400950, laid open for public inspection. With this known pump the fluid to be pumped is driven by the rotation of the pump housing producing centrifugal force towards the circumferential wall of the pump chamber. Near said wall the fluid moves with the rotation of the wall owing to viscous friction. The outlet port of the Pitot member is directed against the flow of the fluid, hence against the rotation of the pump housing, as a result of which, as is known, the linear velocity of the fluid brings about an increase in pressure at the inlet port, the "pressure point".

The known pump has the disadvantage that with the large amount of moving fluid in the pump space the

radial Pitot tube constitutes a comparatively large obstacle and hence a serious impediment for the desired laminar fluid flow. As a consequence, with the desired rapid rotation of the pump housing the fluid in the pump chamber exhibits a strong turbulence, which restricts the attainable increase in pressure, brings about loss of energy and may be the cause of irritating noise.

The invention has for its object to obviate the aforesaid disadvantages and provides to this end a pump of the type referred to in the preamble, said pump being characterized in that the Pitot member is a non-circular dis arranged in the pump space and having such a shape that together with the walls of the pump space it bounds at least one semi-sickle-shaped pump chamber terminating in the direction of rotation of the pump housing in a substantially radial wall having at least one outlet port.

Further features of the pump embodying the invention will now be described with reference to a drawing. The drawing shows in

Fig. 1 a plan view, partly broken away, of a pump in accordance with the invention,

Fig. 2 a cross-sectional view taken on the line II-II in Fig. 1, and

fig. 3 a cross-sectional view taken on the line III-III in Fig. 1.

In the drawing the direction of the fluid flow is indicated by an arrow, where this is necessary.

The jacket 1 of the pump 2 is standing on a foot 3. Inside the jacket 1 is accommodated a pump housing 5 rotatably drivable by a motor (not shown) through a driving shaft 4 and having a concentric, cylinder-disc-shaped pump space 6 in which opens out an inlet duct 7. The rotary axis 23 of the driving shaft 4 and the pump housing 5 is indicated by a dot-and-dash line. Near the circumferential wall of the pump space 6 is located the

outlet port 16 of a fixed, non-rotatable Pitot member 11 communicating with an outlet duct 9, said member being a non-circular disc arranged in the pump space 6 and having a shape such that together with the walls of the pump space 6 it bounds a semi-sickle-shaped pump chamber 12, which terminates in the direction of rotation of the pump housing 5 in a radial wall 14 in which an outlet port 16 is provided.

As a result of this construction the fluid in the pump chamber 12 exhibits only a slight tendency to turbulence and cavitations so that the pressure build-up caused by the Pitot effect near the outlet port 16 may be optimal.

One of the head walls, in the embodiment shown the left-hand head wall 18, has a plurality of radial slots 25. The distance between said head wall 18 and the Pitot member 11 is equal to at the most half the depth of the slot 25. It is thus ensured that the head wall 18 and the Pitot member 11 can move relative to each other substantially without friction, whilst nevertheless the centrifugal effect of the slots 25 is not disturbed by turbulence of the fluid present in the free space between the head wall 18 and the Pitot member 11.

The distance between the other head wall 19 of the pump space and the Pitot member 11 may, as is shown, be advantageously at least twice the distance between the head wall 18 and the Pitot member 11. As a result the viscous losses in the space between the head wall 19 and the Pitot member 11 are limited to extremely low values.

Particularly advantageous is the embodiment shown in which the Pitot member 11 comprises two plates 21, 22 disposed transversely with respect to the rotary axis 23 and separated by a substantially cylinder-disc-shaped cavity 20.

The inlet duct 7 leading to the pump space 6 is formed by a tube extending coaxially through the

Pitot member 11.

The wall 18 of the pump space 6, opposite the outlet duct 7, has a coaxially located depression 24, the depth of which is at least equal to the depth of the slot 25 and the diameter of which exceeds the outer diameter of the inlet duct 7, the slots 25 joining said depressed portion 24. In this way a very quiet fluid flow is obtained. The distance between the bottom of the pressed portion 24 and the exit of the inlet duct 7 is equal to one quarter of the inner diameter of the inlet duct 7. This feature also ensures a quiet flow without turbulence and cavitations.

In order to avoid abrupt velocity variations attended with turbulences and cavitations the overall cross-sectional area of the slots 25 at the location of their junction with the depressed portion 24 is substantially equal to the product of the inner circumference of the inlet duct 7 and the distance between the bottom of the depressed portion 24 and the exit of the inlet duct 7.

The outlet duct 9 is formed by a tube arranged around the inlet duct 7 and disposed coaxially herewith.

The sickle-shaped pump chamber 12 is completely open on the side facing the head wall 18 of the pump space 6. The plate 22 has substantially the form of a true circle, whereas the plate 21 has a shape matching the shape of the circumferential surface of the Pitot member 11. It is thus further ensured that the fluid will be in a quiet flow in the space between the Pitot member 11 and the head wall 19 of the pump space 6.

The pump according to the invention is not only suitable for increasing the pressure of a fluid but also for separating a number of mixed fluids of different specific masses. For this purpose the pump 1 will comprise a number of Pitot members corresponding with the number

of fluids to be separated, the inlet ports of which are spaced apart by different radial distances corresponding to the specific masses.

In the embodiment shown the Pitot member 11 comprises two separate Pitot elements 27 and 28. Each Pitot element 27, 28 comprises a semi-sickle-shaped pump chamber 12, 13 also bounded by the circumferential wall 8 of the pump space 6 and a radial wall 14, 15 having an outlet port 16, 17 which communicates through the cavity 20 comprising two compartments 27, 28 separated by a partition 34 with the outlet duct 9 comprising two hollow parts 30, 31 also separated by the partition 34. The hollow parts 30, 31 are provided with outlet sockets 32, 33, each of them conducting away one of the fluids. The partition 34 may, as an alternative, be arranged at an angular position differing from that shown.

It will be obvious that one single Pitot member is sufficient for a pump not built for the separation of different fluids. In this case only one pump chamber, for example, the pump chamber designated by 12, is provided. The partition 34 can be omitted. The outlet duct 9 needs not be separated into two parts, whilst furthermore only one outlet socket 32 or 33 is required.

With the construction described and illustrated the Pitot member 11 is appropriate for a unitary structure. In this case it may be manufactured by spray-casting. The Pitot member 11 may be made from metal, fibre-glass, a synthetic resin or a combination thereof. For pumping aggressive fluids certain synthetic resins or fibre-glass are preferred. The other parts coming into contact with the fluid have, of course, to be resistant to chemical corrosion.

The bearings 35 of the driving shaft 4 are of the type capable of withstanding the axial and radial loads produced at high rotational speeds. The jacket 1

supports the pump housing 5 on the side remote from the driving shaft 4 through sealing rotary bearings 36 and a sleeve 37, which is freely rotatable about the outlet duct 9. An annular stop member 38 serves to fix the pump housing 5 in the desired axial position. With this construction no fluid will flow along the seal. The seal is covered by a fluid film. Soiling and wear are thus minimized. If desired, a neutral lubricant, a "barrier fluid" may be introduced through a lubricating aperture 39.

Instead of using radial slots 25 in the wall 18, tubes may be employed. However, the cost of manufacture of the pump are then higher.

With the pump according to the invention care is taken for the fluid flow to be laminar as far as possible at all cirtical points, as is described in the foregoing. The comparatively large dimensions and the shape of the cavity 20 and the compartments 27, 28 also contribute to a quiet flow pattern. Not shown is an embodiment in which the communication between the outlet ports 16, 17 and the hollow parts 30, 31 are each formed by a channel.

The pump is suitable for supplying large amounts of fluid, particularly high-pressure fluids as can be obtained by plunger pumps, multi-stage pumps or a number of cascaded pumps.

CLAIMS

1. A pump of the Pitot type comprising a rotatably drivable pump housing having a concentric, cylinder-disc-shaped pump space in which opens out an inlet duct for introducing a fluid and near the circumferential wall of which is located the inlet port of at least one fixed Pitot member communicating with an outlet duct, characterized in that the Pitot member is formed by a non-circular disc arranged in the pump space and having such a shape that together with the walls of the pump space it bounds at least one semi-sickle-shaped pump chamber terminating in the direction of rotation of the pump housing in a substantially radial wall having at least one outlet port.

2. A pump as claimed in Claim 1 having a pump space, one of the head walls of which has one substantially radial slot, characterized in that the distance between said head wall and the Pitot member is at the most equal to half the depth of said slot.

3. A pump as claimed in Claim 2, characterized in that the distance between the other head wall of the pump space and the Pitot member is at least twice the distance between the first-mentioned head wall of the pump space and the Pitot member.

4. A pump as claimed in anyone of the preceding claims, characterized in that the Pitot member comprises two plates arranged transversely of the rotary axis and separated from one another by a substantially cylinder-disc-shaped cavity.

5. A pump as claimed in anyone of the preceding claims, characterized in that the inlet duct leading to the pump space is formed by a tube extending coaxially through the Pitot member.

6. A pump as claimed in claim 5, characterized in that the wall of the pump space opposite the outlet end of the inlet duct has a coaxial depressed portion, the depth of which is at least equal to the depth of the slot and the diameter of which exceeds the outer diameter of the inlet duct, the or each slot joining said portion.

7. A pump as claimed in claim 6, characterized in that the distance between the bottom of the depressed portion and the exit of the inlet duct is equal to substantially one quarter of the inner diameter of the inlet duct.

8. A pump as claimed in claim 6 or 7, characterized in that the overall cross-sectional area of the slots at the location of their junctions with the depressed portion is substantially equal to the product of the inner circumference of the inlet duct and the distance between the bottom of the depressed portion and the exit of the inlet duct.

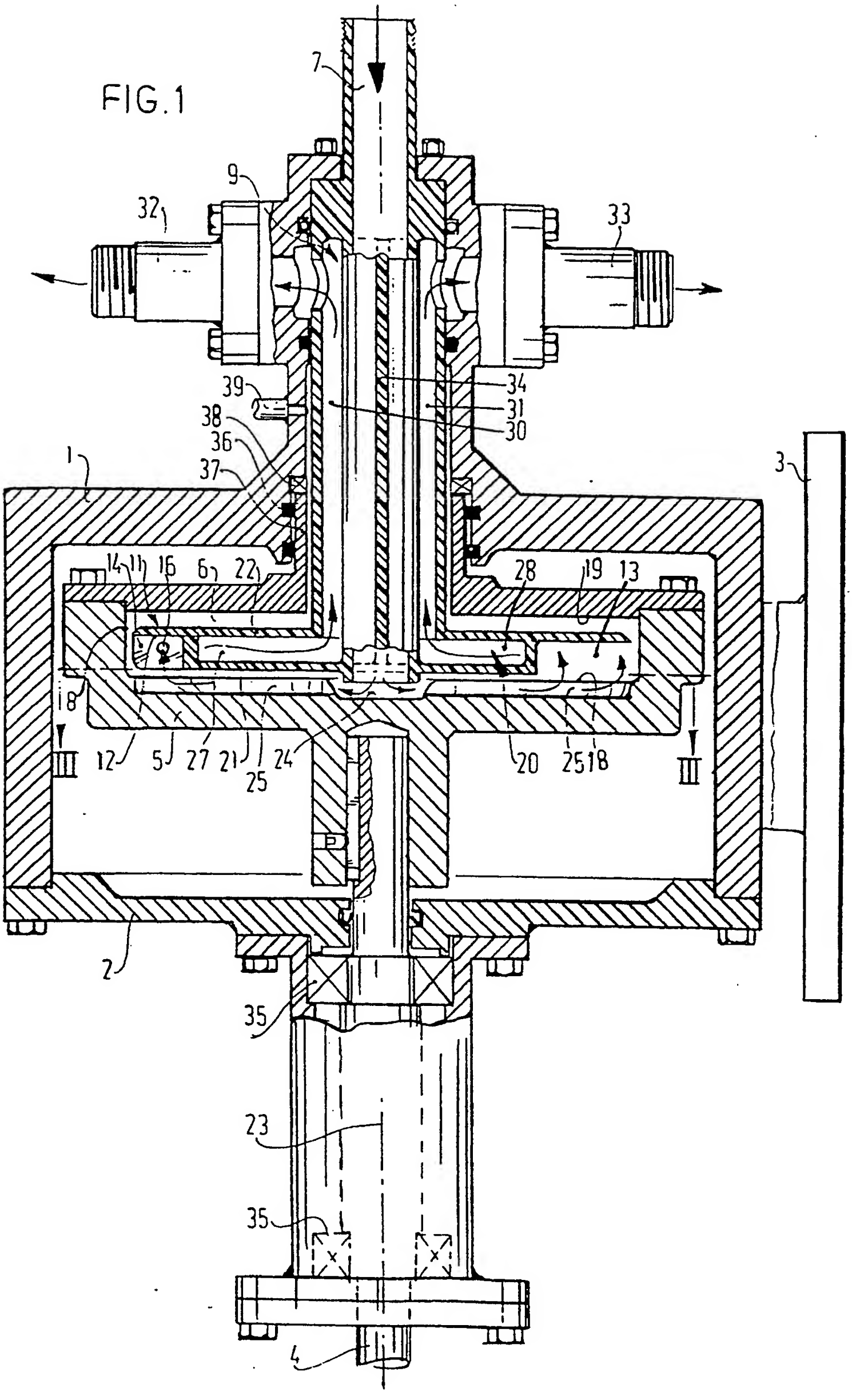
9. A pump as claimed in anyone of claims 5 to 8, characterized in that the outlet duct is formed by a tube arranged coaxially around the inlet duct.

10. A pump as claimed in anyone of the preceding claims, characterized in that the or each sickle-shaped pump chamber is completely open on its side facing the head wall on the inlet side of the pump space.

11. A pump as claimed in claim 9 or 10, characterized in that the inlet duct and the outlet duct are integral with the Pitot member.

12. A pump as claimed in anyone of the preceding claims, characterized by at least two Pitot members, the inlet port of at least one of which is spaced from the axis by a radial distance differing from that of the other.

FIG.1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